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Aphrodisiac efficacy of *Blepharis sindica* seeds: A comparative assessment using different solvent types

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Sexual dysfunction, particularly male infertility has long been identified, discussed and documented in ancient literature worldwide. Now, this syndrome has been well established by the civilizing process of a human being extravagant with a sedentary lifestyle, environmental factors and changing food habits. In the present study aphrodisiac properties of *Blepharis sindica* seeds were clinically evaluated with quantitative evaluation of bioactive molecules, and with some biological, physical, behaviour (Psychological) and biochemical parameters. These parameters were evaluated with different solvents *viz*., ethanol, hydroalcholic and acetone. The concentration of steroidal sapogenin and alkaloid were recorded higher with ethanol compared to two other solvents. Extracts showed positive impacts of the drug on sex organ weight (seminal vesicle, prostate, epididymis, and Vas-deferens), sexual behavior parameters (higher mount and intromission frequency; lesser mount latency, intromission latency and post- ejaculatory interval) and testosterone levels in treated animals. By and large, our outcomes have uncovered that the ethanol concentrate of *B. sindica* seeds could be utilized as a stimulator of sexual conduct in male rats. The sexual enhancer impact of the plant extract may be because of the vicinity of alkaloids and steroidal sapogenin with activation of certain hormones and neurotransmitters.

Keywords: Alkaloid, Male infertility, Prostate, Solvent extraction, Steroidal sapogenin, Testosterone

Male sexual reaction cycle said to be normal if all the steps move ahead timely and consecutively, if any, of the accompanying, is not in sequence or postponed, then it leads sexual dysfunction. Male sexual dysfunction incorporates erectile dysfunction (ED), ejaculation disorders, orgasmic dysfunctions and disorders of sexual interest/desire. Altered lifestyle, pollution, chemical-based foods, lack of nutrition, stress, occupational factors, psychological disorders, androgen deficiencies, chronic medical conditions, penile disease, pelvic surgery, neurological disorders, drugs side effects, lifestyle, aging and systemic diseases are major factors associated with male infertility[1,2].

World statistics about male infertility suggested that one in ten men in the world are thought to suffer from erectile dysfunction; further, 80% of all the cases the causes of erectile problems are down to physical reason. There are evidence to show that sperm counts have been declining over the last 50 years, with a consequent increase in male infertility. The magnitude and patterns of male infertility in the India have been reported by researchers[3,4].

In the present study, we evaluated the relative aphrodisiac efficacy of *Blepharis sindica* seeds with utilizing distinctive sorts of solvents. The preliminary *in-vitro* aphrodisiac potential of this species have been established[5]. *Blepharis sindica*, locally known as "Bhangari" is a small serotinous, dichotomously branched woody, arid annual having a short stem, sessile leaves, and fruit in the form of a capsule (Fig. 1). Each capsule having two seeds and each seed

Fig. 1 — Dry *Blepharis sindica* plant with capsule

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covered with hygroscopic hairs on its surface[6]. Preliminary clinical study of its ethnic aphrodisiac knowledge conducted by Mathur and Sundaramoorthy[5] and their study indicated the presence of high androgenic compounds in the seeds that reflected in an increase in weight of seminal vesicle, ventral prostate and some vital organs like heart, kidney, and liver. Thus, a confirmatory clinical study still requires to establish its aphrodisiac property by using physical, biochemical and behavior parameters as well as to correlate the role of some bioactive components (steroidal sapogenin and alkaloid) with these parameters.

Major objectives of the present study are: (i) To assess the aphrodisiac efficiency of *Blepharis sindica* seeds with utilizing diverse sorts of extracts using solvents like ethanol, hydro-alcoholic and acetone with the expectation to know extraction adequacy that acknowledges through biological parameters *viz*., physical, biochemical and behavior (Psychological) parameters; and (ii) Quantify the bioactive components (steroidal sapogenin and alkaloid) in seed with different solvent extractions and quantify their potential relationships with the above-mentioned biological parameters.

Materials and Methods

Procurement and authentification of plant

The plant of *Blepharis sindica* was collected from Bhopalgarh and Jodhpur areas, identified and authenticated by resource persons of Plan Ecology Section herbarium of Central Arid Zone Research Institute, Jodphur (Voucher number. 1119-1961). Powdered seed extracts prepared by successive soxhlet extraction using ethanol, hydro-alcoholic and acetone solvents. Each extract was then subjected to quantitative estimations of bioactive molecules and finally for the pharmacological screening by using animal models for aphrodisiac activity.

Quantification of secondary metabolites

Total steroidal sapogenin quantified through spectro-photometric method[7] and modified by Chen *et al*.[8] Standard prepared with diosgenin and ethyl acetate, acetic anhydride, and sulphuric acid were the major reagents. The absorbance of the supernatant fluid measured at 430 nm. Total alkaloid content was quantified according to Higuchi and Bodin[9]. Air-dried, powdered plant material extracted with different solvents. The computation of percent yield was based on gravimetric method. However, their identity as alkaloids was confirmed by positive color test with Dragendroff's, Mayer and Wagner's reagent[10].

Animals and Aphrodisiac activity study

Inbred adult Wistar albino male rats were used for the study (CPCSEA registered number 1258/ac/09). The animals were fed with standard animal feed and water. The animals were housed at a temperature of 25 ± 1°C with a reversed light-dark cycle and relative humidity of 50-55%. The study was performed as per the protocol and recommendation of the Institutional Animal Ethics Committee (IAEC), India. All animal experiments were conducted in accordance with the NIH guideline for the care and use of laboratory animals (NIH Publication No. 80-23; revised 1978). Male rats (n = 6/group) were trained for sexual experience. To provide sexual experience, each male rat was allowed 30 min exposure to a female rat in behavioral estrous, several days before testing for copulatory performance in a transparent arena. The animals were tested three times over a 10 day period for copulatory behavior and divided into active and inactive groups. Sexually active animals were divided into control, positive control, standard and *B. sindica* seeds extract treated (500 mg/kg body weight) groups[11]. Male rats were castrated using a standard procedure. They were allowed to recover from the surgery for 7 days. Females were brought into estrous by the administration of a single subcutaneous dose of estrogen benzoate (2 GM/kg body wt.) and progesterone (500 GM/kg body wt.), 48 and 6 h before the copulatory study.

Castration process

Incision of 20-30 mm was made with the help of sharp scalpel and then testis removed followed by ligation of blood vessels. The stretches were made after removal of the testis. Antibiotic therapy was given for 7 days with local application of benzyl penicillin powder (Penicillin G) and framycetin 1% ointment[12].

Experimental design

Group 1: Control, normal rats, given vehicle only; Group 2: Positive control, castrated rats given vehicle only; Group 3: Standard group, castrated rats given standard testosterone propionate injection subcutaneously; Group 4-6: Test group, castrated rats, given (500 mg/kg body wt.) (a) ethanol extract, (b) hydro-alcoholic extract and (c) acetone extract in 1% Acacia.

Dosing of drugs

The suspension of the extract in gum acacia 1% as per required doses were administered orally different groups of male rats (n = 6) once a day for 21 days. Testosterone propionate (0.01 mg/kg body wt., s/c) was given as a standard drug.

Sexual behavior study

The following sexual behavior parameters were recorded: I. Mount Latency (ML): the time interval between the introduction of the female and the first mount by the male; II. Intromission Latency (IL): the interval from the time of introduction of the female to the first intromission by the male (characterized by pelvic thrusting and springing dismount); III. Ejaculation Latency (EL): the time interval between the first intromission and ejaculation (characterized by longer, deeper pelvic thrusting and slow dismount followed by a period of inactivity); IV. Mount Frequency (MF): the number of mounts observed in 30 min; V. Intromission Frequency (IF): the number of intromissions observed in 30 min; VI. Ejaculation Frequency (EF): the number of ejaculations observed in 30 min; and VII. Post-Ejaculatory Interval (PEI): the time interval between ejaculation and the first intromission of the following series[13].

Testosterone

Serum testosterone level (ng/dL) quantified through spectro-fluorimeter (Chemiluminescence) fully automatic machine IMMULITE 1000 (SIEMENS) with the help of standard markers. Samples were analyzed from "ROG-NIDAN" private pathology laboratory, situated at the Inside Jalori Gate, Jodhpur, Rajasthan, India, under the guidance of pathologist Dr. Subodh Saxena (MD). An entire cold chain was maintained during preparation, storage, and transportation of serum samples.

Dissection and Removal of genitals

After the completion of the dosing schedule on 21st day, all the animals of each group were sacrificed by cervical decapitation method. After that, the genital organs such as: Seminal vesicle, prostate, vas-deferens, epididymis *etc*. were isolated, weighed them on digital analytical balance followed by their preservation in 40% formaldehyde solution.

Data analysis

Pairwise statistical comparisons between control and treated animals were performed. The groupings were done with student's t-test. Mean differences were considered statistically significant and observed *P* value is <0.05. To explore the relationships between secondary metabolites and the biological parameters, factor analysis like Principal Component Analysis (PCA) used as a data reduction technique. This ordination method was conducted by following Ward method by using STATISTICA software. Further, the pathways of probable relationships between bio-active compounds and biological parameters were assessed through regression analysis. In regression analysis, biological parameters were considered as dependent variables while bioactive molecules were the exploratory variables and the regression equation was selected with the higher R^2 value (at 99% probability level = ** and 95% probability level = *)

Results

In present study 2.7, 6.2, and 3.9% (w/w) yields of *B. sindica* seeds glean with ethanol, hydroalcohol and acetone solvents, respectively. With each solvent extract, steroidal sapogenin and alkaloid were quantified and the results are depicted in Table 1. Among the different solvent types higher quantity of steroidal sapogenin (µg/g), an alkaloid (%) was recorded with ethanol compared to hydro alcoholic and acetone. Thus, for steroidal sapogenin, ethanol extract showed 54.18% and 206.02% higher extractable capacity compared to hydro-alcoholic, and acetone solvents, respectively and similar trends also recorded for alkaloid. Further, bio-availability of these metabolites also assessed through administration of 500 mg/kg body weight seed extracts of selected solvents. The crude extracts brought forward following physical, behavior and biochemical changes in treated animals.

Physical parameters

Effect of various extractions of *B. sindica* seed on sexual organs is summarized in Table 2. Compared to the positive control, 72.41, 6.57, and 1.52% increase in seminal vesicle weight recorded with ethanol, hydro-alcohol, and acetone, respectively. Similar higher positive impacts of ethanol extract on prostate, vas-deferens and epididymis observed as compared with two other types of solvent. With ethanol extraction 16.93%, 26%, and 21.50% increase in weight of the prostate, vas-deferens, and epididymis recorded as compared with positive control, respectively.

Sexual behaviour

The sexual behaviour of the animal also improved upon treatment with all three solvent types (Table 3).

Table 1—Concentrations of secondary metabolites in different solvents

Secondary Metabolites	Ethanol	Hydro alcoholic	Acetonic
Steroidal sapogenin µg g^{-1}	1129.59 ± 1.0	432.6 ± 10.2	369.1 ± 17
Alkaloid % yield	2.9 ± 0.4	2.4 ± 0.6	1.8 ± 0.07

Table 2 — Effect on Organs weight (mg) by various extract after 21 days

Behavior Parameters	Groups					
	Control	Positive control	Standard	Ethanol	Hydro alcoholic	Acetonic
Seminal vesicle	4.6 ± 5.0	207.8 ± 1.4[a]	401.3 ± 4.8[b]	358.3 ± 19.5[b]	221.5 ± 5.4	21 ± 2.4
Prostate	5.9 ± 3.16	387.6 ± 1.7[a]	555.3 ± 4.48[b]	453.3 ± 18.2[b]	432.1 ± 12.7[c]	396.5 ± 3.5
Vas-deferens	373.8 ± 1.8	183.3 ± 2[a]	293.5 ± 1.8[b]	231.0 ± 7.6[b]	184.8 ± 3	186 ± 2
Epididymis	1882.6 ± 5.7	91.17 ± 3.8[a]	1786.0 ± 41.9[b]	1108.3 ± 41.9[b]	931.6 ± 16.3	941.6 ± 13.5

Values expressed as Mean ± SEM shows the effect of treatment with various extracts on weight of genital organs in castrated rats (n=6). [a] P <0.0001 when compared normal control with positive control by using t-test. [b] P <0.01; [c] P <0.05 when compared the other groups with positive control by using ANOVA followed by Dunnet's test

Table 3 — Behavior Parameters Study after 21 Days

Behavior Parameters	Groups					
	Control	Positive control	Standard	Ethanol	Hydro alcoholic	Acetonic
MF	28.8 ± 1.1	15 ± 1.1[a]	24.6 ± 1.4[b]	27.3 ± 1.2[b]	20.8 ± 1.0[c]	15.5 ± 2.2
ML	21.8 ± 1.2	142.1 ± 9.8[a]	23.0 ± 1.1[b]	32.6 ± 2.5[b]	50 ± 5.2[b]	140 ± 5.1
IF	5.1 ± 0.6	2.3 ± 0.4[d]	5.3 ± 0.4[b]	5.4 ± 0.3[b]	3.1 ± 0.3	2.5 ± 0.4
IL	25.8 ± 1.7	227.5 ± 14.9[a]	28.8 ± 2.4[b]	43.6 ± 2.8[b]	75.0 ± 4.9[b]	177.1 ± 7.8[b]
EF	2.6 ± 0.4	2.1 ± 0.4	2.3 ± 0.3	2.1 ± 0.31	1.6 ± 0.3	1.8 ± 0.31
EL	6.5 ± 0.5	3.3 ± 0.4[d]	5.3 ± 0.4[b]	6.0 ± 0.3[b]	4.5 ± 0.4	4 ± 0.3
PEI	3.5 ± 0.5	10.8 ± 1.5[d]	3.6 ± 0.4[b]	3.8 ± 0.4[b]	8.6 ± 0.9	10.5 ± 1.3

Values expressed as Mean ± SEM, shows the effect of treatment with various extracts on Psychological behavior in castrated rats (n=6). [a] P <0.0001; [d] P <0.01 when compared normal control with positive control by using t-test. [c] P <0.05; [b] P <0.01 when compared the other groups with positive control by using ANOVA followed by Dunnet's test

Mount latency, intromission latency, and post ejaculation interval significantly reduced with all treated groups compared to positive control and higher reduction in above three parameters recorded with ethanol extract (−77.02, −80.80 and −64.63%, respectively); however, higher reduction in ejaculation frequency recorded with hydro-alcoholic followed by acetone and least with ethanol. Results divulged increases in mount frequency, intromission frequency and ejaculation latency with all groups compared to positive controls and here also, ethanol extract showed more positive impacts on these parameters compare to two other types.

Table 4 — Effect on Serum Testosterone level (ng/dL)

Groups	Testosterone level (ng/dL)
Control	260.1 ± 6.6
Positive control	117.5 ± 2.8[a]
Standard	224 ± 9.9[b]
Ethanolic	205.3 ± 9.0[b]
Hydro alcoholic	186.5 ± 9.7[b]
Acetonic	172.1 ± 6.6[b]

[Values expressed as Mean ± SEM ,shows the effect of treatment with various extracts on Serum Testosterone level (ng/dL) in castrated rats (n=6). [a] P <0.0001 when compared normal control with positive control by using t-test. [b] P <0.01 when compared the other groups with positive control by using ANOVA followed by Dunnet's test]

Biochemical parameters

Compared to the positive control, 74.74, 58.72 and 46.51% higher testosterone recorded in treated animals with ethanol, hydro-alcoholic, and acetone, respectively (Table 4). Thus, above physical, behavior and biochemical parameters indicated a potential of *B. sindica* seeds for correcting male infertility and their associated problems.

In Principal Component Analysis (PCA), as to the cumulative percentage, the first two axes together accounted for 89.42 and 10.57% of the variability in the data sets related to physical, sexual, biochemical and secondary metabolites (Table 5). PCA ordination analysis revealed no harbinger of any arch or horse show effect (Fig. 2), *i.e.* different variables are well linked and distributed with their respective axis. Thus, for present study PCA analysis is substantiated as an adequate technique that explained the variables in descriptive and in independent manners. Squared cousins were used to link the variable with the corresponding axis (Table 5), and the greater the squared cosine, the greater the link. However, in order to determine physical, sexual, biochemical and secondary metabolites variables sustaining these interrelationships, concept of a component defining variables (CDV) employed, which stipulates the selection and subsequent naming of variables with the highest component loading (correlation coefficient) as variables that provide the best relationships[17]. Based on this criterion, in the present study, PCA bi-plot showed some relationships between the studied parameters (Fig. 2).

Relationships of sex organ weight with secondary metabolites

Both steroidal sapogenin (Prostate = 342.87 + 0.166 × Steroidal Sapogenin + −6.06 × Steroidal Sapogenin$^{\wedge 2}$; R^2 = 1.00; P <0.01) and alkaloid content (Prostate weight (mg) = 308.11 + 49.26 × Alkaloid; R^2 =0.99; P <0.01) supports the prostate weight in quadratic and linear fashions, respectively.

Relationships of behavior parameters with secondary metabolites

Steroidal sapogenin (Mount Frequency = 9.62 + 0.015 × Steroidal Sapogenin, R^2 = 0.99; P <0.01), and alkaloid contents (Mount Frequency = −2.87 + 9.96 × Alkaloid, R^2 = 0.988; P <0.05) showed linear relationships with mount frequency. Similarly intromission frequency showed supportive behavior of steroidal sapogenin (Intromission Frequency = 3.188 + −0.003 × Steroidal Sapogenin + 5.0625 × Steroidal Sapogenin$^{\wedge 2}$; R^2 =1.00; P <0.01) in quadratic fashion. Steroidal sapogenin (Ejaculation Latency = 2.864 + 0.0026 × Steroidal Sapogenin, R^2 =0.967; P <0.05) exhibited linear positive relationships with ejaculation latency. While steroidal sapogenin showed linear negative relationships with post ejaculatory interval (Post-Ejaculatory Interval = 14.22 + −0.008 × Steroidal Sapogenin, R^2 =0.973; P <0.05).

Table 5 — PCA analysis with relationships of various parameters on different axes

Parameters	F1	F2
Eigenvalue	12.520	1.480
% variance	89.428	10.572
Cumulative %	89.428	100.000
Steroidal Saponin	−0.989	−0.149
Alkaloid	−0.964	−0.265
Seminal vesicle	−0.960	0.281
Prostate	−0.948	−0.319
Vas-Deferns	−0.932	0.362
Epididymis	−0.921	0.389
Testosterone	−0.995	−0.097
MF	−0.993	−0.115
ML	0.854	0.521
IF	−0.992	0.128
IL	0.891	0.455
EF	−0.781	0.625
EL	−0.994	0.106
PEI	0.997	−0.080

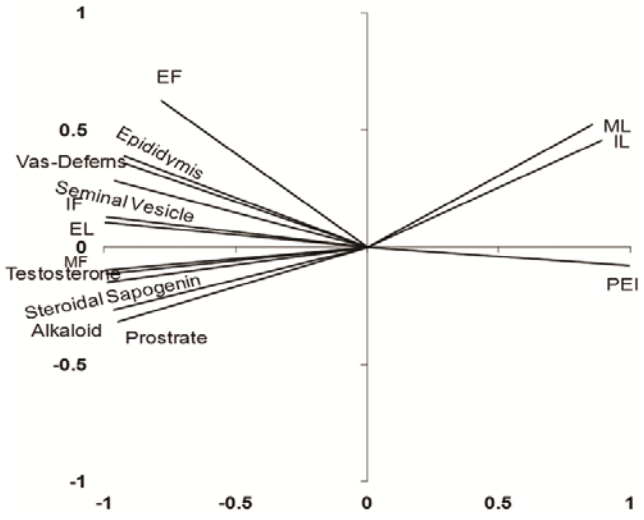

Fig. 2 — Principal Component Analysis

Relationships of biochemical parameters with secondary metabolites

The study revealed that steroidal sapogenin (Testosterone = 155.511 + 0.0436 × Steroidal Sapogenin, R^2 = 0.99; P <0.01) supports testosterone levels in a linear manner.

Discussion

Biological performance of any crude drug directly or indirectly comments on their phytochemical composition. The absorption of these phytochemicals, related to the solvent extraction efficiency and governance of such crude drug reflects in biological properties. Contingent upon aphrodisiac substances, their pharmacological properties may regulate through the hypothalamus-pituitary-testicular axis. Some of the secondary metabolites like steroidal sapogenin, alkaloids and flavonoids prestige the endocrine systems which, reflected through increase in testosterone level, enhanced sexual motivation (increase mount frequency and reduce mount latency), exalted sexual performance (increase intromission frequency and decrease intromission latency) and enhanced sexual pleasure (prolonged ejaculation frequency, prolonged ejaculation latency, reduced post-ejaculatory interval) (Fig. 3). The role's of neurotransmitters and hormones has been widely concentrated on and there is developing confirmation that some of them may have constructive outcomes on sexual execution. Certain neurotransmitters and peptides, for example, dopamine, oxytocin and adrenocorticotrophic hormone (ACTH), have promoter impacts on sexual conduct while, γ-aminobutyric acid (GABA), endogenous opioids and norepinephrine seem, by all accounts, to be inhibitors.

Among the herbal supplements, *Tribulus terrestris* improves sexual desire and enhances erection by neurosteroids that act centrally as γ-aminobutyric acid. Similarly, other clinically tested herbal

aphrodisiacs includes *Mondia whiteii*, *Pouzolzia hypoleuca, Cassia singueana*, *Elephantorrhiza goetzi, Lepidium meyenii*, *Trichilia catigua*, and *Ptychpetalum olacoidesi*[14].

Various phytochemicals have been reported to affect penile erection by different mechanisms. The alkaloid yohimbine, for example, stimulates the peripheral and central nervous system by acting on α-adrenoceptors[15]. Yohimbine is an indole alkaloid extract from the bark of the *Pausinystalia yohimbe* Pierre ex Beille (Rubiaceae). According to the literature the action of yohimbine in the fringe and focal sensory system ought not be confined to the noradrenergic framework additionally reached out to the serotonergic framework (neurotransmitter control of sexual activities)[15]. A conceivable system for development in the erectile capacity of patients treated with yohimbine was created after the identification and portrayal of utilitarian α2-adrenergic receptors in human corpus cavernosum[16]. Alkaloids might likewise act

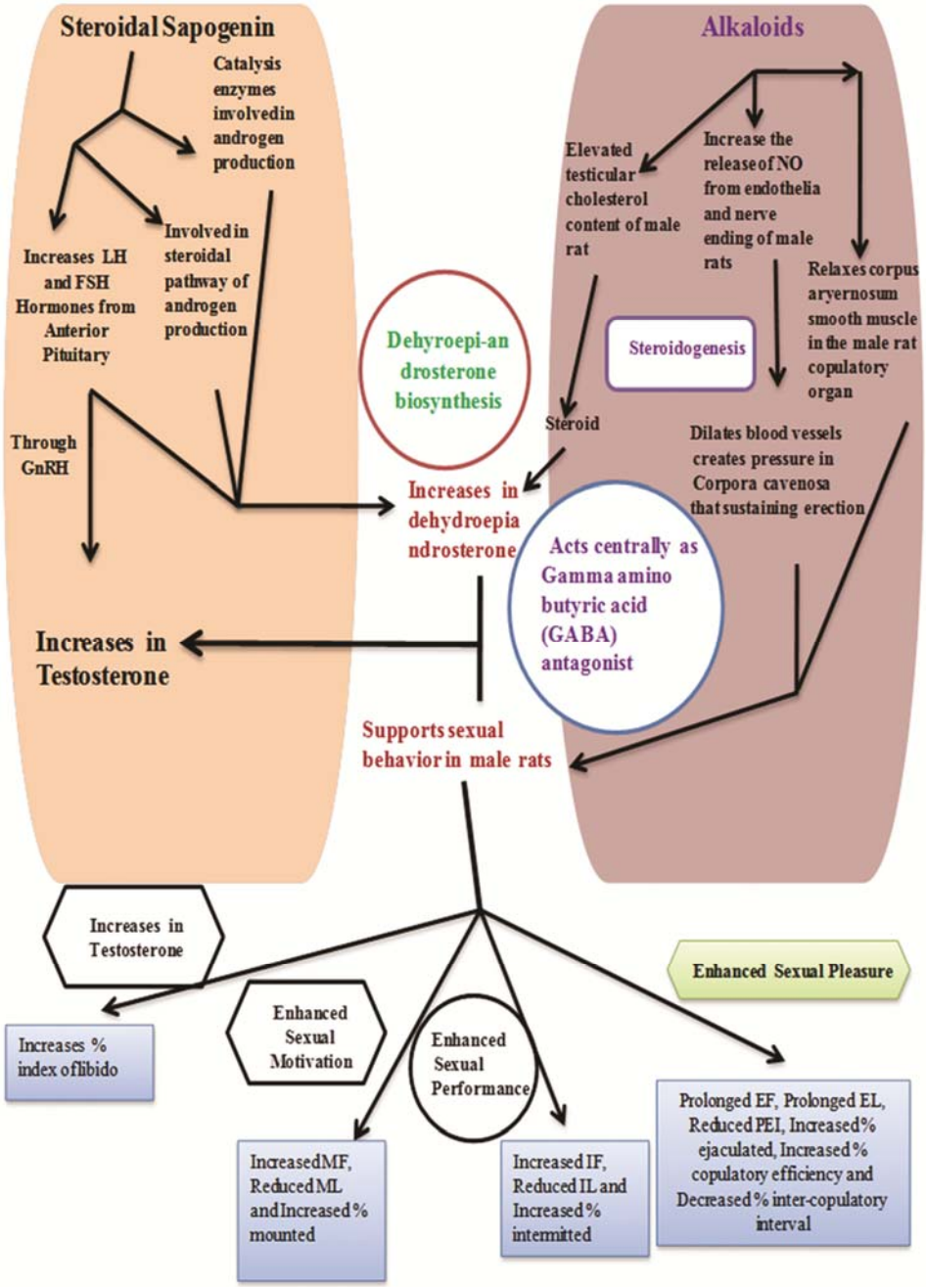

Fig. 3 — Possible Pathways Associated with Aphrodisiac Properties of *Blepharis sindica* Seeds

incidentally by unwinding corpus cavernosum smooth muscle in the copulatory organ of the male rats. Alkaloids have been shown to have ergogenic properties by inducing vasodilation of the blood vessels which consequently result in an erection. Furthermore, the aphrodisiac property of *P. gingseng* root has additionally been ascribed to upgrade acetylcholine-instigated and mount latency and intromission latency that are pointers of sexual inspiration. Arletti *et al.*[17] demonstrated that saponin extracts of *Turnera diffuse* and *Pfaffia paniculata* improved the copulatory performance of sexually sluggish or impotent rats. They also attributed that these results brought through increased central noradrenergic and dopaminergic tone and possible oxytocinergic transmission.

Saponins may have aided in the invigorating increment in the body regular endogenous testosterone levels likely by raising the level of luteinizing hormones, which interpreted into the male sexual fitness saw in this study. Furthermore, for explaining the present finding, it can be asserted that steroidal sapogenin may tie to hormone receptors, which may bring about conformational change that will improve the physiological capacity of the hormone or tie to catalysts that are included in the formation of such hormones and accordingly increase its production. According to Gaunthaman and Adaikan[18], the steroidal nature of saponins may facilitate its role as an intermediary in the steroidal pathway of androgen production.

Clinical information on testosterone likewise recommends that a slight increment in the levels of the hormone in adult male brings about a moderate however critical increment in sexual craving and libido. Consequently, the increment in serum testosterone concentration by the ethanol extract of *B. sindica* seed may be responsible for the enhanced sexual behaviors in the animals.

Dehydroepiandrosterone (DHEA), a major circulating steroid in the plasma, and a typical antecedent for both androgens and estrogens acts midway as a gamma amino butyric corrosive opponent to encourage sexual capacity. The conceivable increment in DHEA, its consequent changes to testosterone and its metabolites may represent the observed enhanced masculinity conduct in this study. Mount recurrence and intromission recurrence are valuable indicators of vigor, moxie, and intensity. The number of mount (MF) reflects sexual inspiration, an increment in the quantity of intromission (IF) demonstrates the effectiveness of the erection, penile orientation and the straightforwardness by which ejaculatory reflexes are actuated[4]. In this way, the huge increment in MF and IF proposes enhanced libido and such enhancement of libido may have emerged from increment in the amassing of a few anterior pituitary hormones and serum testosterone, which thusly empowered dopamine receptor blend and sexual conduct[1].

It might consequently be legitimate to recommend that the sex-enhancing conduct of the tested animal may be because of steroidal sapogenin constituents of the *B. sindica* seeds since they have been accounted for to adjust androgen levels[19]. Moreover, since intromission is unrealistic without sufficient erection and composed action of penile muscle[20] the increment in IF by the concentrate in this study proposes that the instrument of the penile erection was initiated. Thusly, ethanol concentrates of *B. sindica* seed may expand potency by permitting or maintaining an erection. The observed changes in testosterone levels of the experimental male rats likewise propose that the *B. sindica* seed extract displayed aphrodisiac impact as upheld[21]. Clinical information on testosterone additionally recommends that a slight increment in the levels of the hormone in adult male brings about a moderate, however noteworthy increment in sexual yearning and libido[22]. The post-ejaculatory interim is viewed as an index of strength, libido and the rate of recuperation from depletion after the first arrangement of mating[23].

A post-ejaculatory interval of more than 5400 second shows that the male is sexually depleted and the force of sexual conduct will be lessened in resulting mating. Subsequently, the essentially diminished post ejaculatory interim with an etahnolic concentrate of *B. sindica* seed further confirmed its aphrodisiac claims. The supportive behavior of steroidal sapgenin and alkaloid content on prostrate can correspondwith an increase alkaline secretion that improve sperm motility[4]. Further, crude extracts additionally uphold the weight gain's of the epididymis, vas-deferens, and seminal vesicle, such results can relate with increase secretion of glycogen (which keep stores sperm cell alive) in epididymis, and fructose (which is the energy source for sperm) in seminal vesicle.

Conclusion

In this study, treatment of the male rats with the ethanolic extracts of *B. sindica* seed significantly

enhanced the sexual parameters more effectively compared to acetonic and hydro-alcholic extracts. Administrations of the crude drug resulted in gain in sex organ weight. Supportive behavior of these extracts on sex organ weight complemented with their extraction efficacy, being recorded maximum ethanol. Hence, it is conceivable that the dynamic principle(s) contained in the concentrate might have crossed the blood-cerebrum barrier of the animals to exert its aphrodisiac impact on the hypothalamus-pituitary-testicular hub. By and large, our outcomes have uncovered that the ethanol concentrate of *B. sindica* seeds could be utilized as a stimulator of sexual conduct in male rats. The sexual enhancer impact of the plant extract may be because of the vicinity of alkaloids and saponins through a huge number of focal and fringe implies.

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